

# Notice of Allowability

Application No.

10/691,868

Examiner

Cuong V. Luu

Applicant(s)

RUETSCH, GREGORY R.

Art Unit

2128

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 7/10/2007.
2. ☒ The allowed claim(s) is/are 1,4-9,12-17 and 20-24.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) ☐ All b) ☐ Some\* c) ☐ None of the:
    1. ☐ Certified copies of the priority documents have been received.
    2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
    3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
  - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
    - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date \_\_\_\_\_.
  - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

## Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date \_\_\_\_\_
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date \_\_\_\_\_
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other \_\_\_\_\_

  
FRED FERRIS  
PRIMARY EXAMINER  
TECHNOLOGY CENTER 2100

### **DETAILED ACTION**

The Examiner would like to thank the Applicant for the well-presented response, which was useful in the examination. The Examiner appreciates the effort to perform a careful analysis and make appropriate amendments to the claims.

Claims 1, 4-9, 12-17, and 20-24 are pending. Claims 2-3, 10-11, and 18-19 have been canceled. Claims 1, 4-9, 12-17, and 20-24 have been examined. Claims 1, 4-9, 12-17, and 20-24 have been allowed.

### **EXAMINER'S AMENDMENT**

**An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.**

**Authorization for this examiner's amendment was given in a telephone interview with attorney Shun Yao on 7/16/2007.**

Paragraph 0031 of the specification has been amended as follows:

[0031] The data structures and code described in this detailed description are typically stored on a computer readable storage medium, which may be any device or medium that can store code and/or data for use by a computer system. This includes, but is not limited to, magnetic and optical storage devices such as disk drives, magnetic tape, CDs (compact discs) and DVDs (digital versatile discs or digital video discs), ~~and computer instruction signals embodied in~~

~~transmission medium (with or without a carrier wave upon which the signals are modulated). For example, the transmission medium may include a communications network, such as the Internet.~~

### ***Response to Arguments***

1. Applicant's arguments, see p. 9, filed 7/10/2007, and the amendments to the specification above, with respect to the U.S.C. 101 rejections of claims 9-16 have been fully considered and are persuasive. The U.S.C. 101 rejections of claims 9-16 have been withdrawn.

### ***Allowable Subject Matter***

**Claims 1, 4-9, 12-17, and 20-24 are allowed. The following is an examiner's statement of reasons for allowance:**

2. As per claim 1, the prior art of record teaches a method for using interval techniques within a computer system to solve a multi-objective optimization problem, comprising:
  - receiving a representation of multiple objective functions ( $f_1, \dots, f_n$ ) at the computer system, wherein ( $f_1, \dots, f_n$ ) are scalar functions of a vector  $x = (x_1, \dots, x_n)$ ;
  - receiving a representation of a domain of interest for the multiple objective functions;
  - storing the representations in a memory within the computer system; and
  - performing an interval optimization process to compute guaranteed bounds on a Pareto front for the objective functions ( $f_1, \dots, f_n$ ), wherein for each point on the Pareto front, an improvement in one objective function cannot be made without adversely affecting at least one other objective function;

wherein performing the interval optimization process involves applying a direct-comparison technique between subdomains of the domain of interest to eliminate subdomains that are certainly dominated by other sub-domains,

but does not teach the above recited limitations in combination with the following limitations:

wherein performing the interval optimization process involves applying a gradient technique to eliminate subdomains that do not contain a local Pareto optimum,

wherein a subdomain  $[x]_i$  is eliminated by the gradient technique if an intersection of certainly negative gradient regions  $C_j$  for each objective function  $f_j$  is non-empty,  $\cap C_j ([x]_i) \neq \emptyset$ ;

wherein the certainly negative gradient region  $C_j$  for objective function  $f_j$  is the intersection of  $N_j ([x]_i)$  (the negative gradient region associated with the minimum angle  $\Theta_j$  of the gradient off over the subdomain  $[x]_i$ ) and  $N_j ([x]_i)$  (the negative gradient region associated with the maximum angle  $\Theta_j$  of the gradient of  $f_j$  over the subdomain  $[x]_i$ ).

as recited by the claimed invention.

3. As per claim 9, the prior art of record teaches A computer-readable storage medium storing instructions that when executed by a computer cause the computer to perform a method for using interval techniques within a computer system to solve a multi-objective optimization problem, wherein the computer-readable storage medium can be any device that can store code and/or data for use by a computer system, the method comprising:

receiving a representation of multiple objective functions  $(f_1, \dots, f_n)$  at the computer system, wherein  $(f_1, \dots, f_n)$  are scalar functions of a vector  $x = (x_1, \dots, x_n)$ ;

receiving a representation of a domain of interest for the multiple objective functions;

storing the representations in a memory within the computer system; and  
performing an interval optimization process to compute guaranteed bounds on a Pareto front for the objective functions  $(f_1, \dots, f_n)$ , wherein for each point on the Pareto front, an improvement in one objective function cannot be made without adversely affecting at least one other objective function;

wherein performing the interval optimization process involves applying a direct-comparison technique between subdomains of the domain of interest to eliminate subdomains that are certainly dominated by other sub-domains,

but does not teach the above recited limitations in combination with the following limitations:

wherein performing the interval optimization process involves applying a gradient technique to eliminate subdomains that do not contain a local Pareto optimum,

wherein a subdomain  $[x]_i$  is eliminated by the gradient technique if an intersection of certainly negative gradient regions  $C_j$  for each objective function  $f_j$  is non-empty,  $\cap C_j ([x]_i) \neq \emptyset$ ;

wherein the certainly negative gradient region  $C_j$  for objective function  $f_j$  is the intersection of  $N_j ([x]_i)$  (the negative gradient region associated with the minimum angle  $\Theta_j$  of the gradient off over the subdomain  $[x]_i$ ) and  $N_j ([x]_i)$  (the negative gradient region associated with the maximum angle  $\Theta_j$  of the gradient of  $f_j$  over the subdomain  $[x]_i$ ).

as recited by the claimed invention.

4. As per claim 17, the prior art of record teaches an apparatus that used interval techniques to solve a multi-objective optimization problem, comprising:

a receiving mechanism configured to receive a representation of multiple objective functions  $(f_1, \dots, f_n)$  at the computer system, wherein  $(f_1, \dots, f_n)$  are scalar functions of a vector  $x = (x_1, \dots, x_n)$ ;

wherein the receiving mechanism is configured to receive a representation of a domain of interest for the multiple objective functions;

a memory configured to store the representations;

an interval optimizer configured to perform an interval optimization process to compute guaranteed bounds on a Pareto front for the objective functions  $(f_1, \dots, f_n)$ , wherein for each point on the Pareto front, an improvement in one objective function cannot be made without adversely affecting at least one other objective function;

wherein performing the interval optimization process involves applying a direct-comparison technique between subdomains of the domain of interest to eliminate subdomains that are certainly dominated by other sub-domains,

but does not teach the above recited limitations in combination with the following limitations:

wherein performing the interval optimization process involves applying a gradient technique to eliminate subdomains that do not contain a local Pareto optimum,

wherein a subdomain  $[x]_i$  is eliminated by the gradient technique if an intersection of certainly negative gradient regions  $C_j$  for each objective function  $f_j$  is non-empty,  $\cap C_j ([x]_i) \neq \emptyset$ ;

wherein the certainly negative gradient region  $C_j$  for objective function  $f_j$  is the intersection of  $N_j ([x]_i)$  (the negative gradient region associated with the minimum angle  $\Theta_j$  of the gradient off over the subdomain  $[x]_i$ ) and  $N_j ([x]_i)$  (the negative gradient region associated with the maximum angle  $\Theta_j$  of the gradient of  $f_j$  over the subdomain  $[x]_i$ ).

as recited by the claimed invention.

**Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."**

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Cuong V. Luu whose telephone number is 571-272-8572. The examiner can normally be reached on Monday-Friday 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini Shah, can be reached on 571-272-2279. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. An inquiry of a general nature or relating to the status of this application should be directed to the TC2100 Group receptionist: 571-272-2100.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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